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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/589,272	06/14/2007	Kiyotaka Ishibashi	294901US26PCT	6058
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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314				
EXAMINER				
DHINGRA, RAKESH KUMAR				
ART UNIT		PAPER NUMBER		
1716				
NOTIFICATION DATE		DELIVERY MODE		
11/28/2011		ELECTRONIC		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/589,272

Applicant(s)

ISHIBASHI ET AL.

Examiner

RAKESH DHINGRA

Art Unit

1716

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 August 2011.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3,5-7 and 9-16 is/are pending in the application.
- 4a) Of the above claim(s) 14 and 15 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3,5-7,9-13 and 16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-946)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 08/11/2011 has been entered.

Response to Arguments

Applicant's arguments with respect to claims 1- 7, 9-13 and 16 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claims 1, 11 by adding new limitations, e.g. in claim 1 new limitation "wherein the gap extends over an entirety of the vertical length such there is a uniform gap width" has been added. Further applicant has cancelled claim 4.

Accordingly, claims 1-3, 5-7 and 9-16 are now pending out of which claims 1-3, 5-7, 9-13 and 16 are now active.

New references by Ishii et al (US 2004/0149741) and Hongo et al (US 2001/0050059) when combined with Ishibashi et al read on limitations of amended claim 1. Accordingly, claims 1- 3, 5, 9 have been rejected under 35 USC 103 (a) as explained below. Additionally, new reference by Hongo et al (US 2001/0050059) when combined with Hongoh et al reads on limitations of amended claim 11. Accordingly, claims 11-13 have been rejected under 35 USC 103 (a) as explained below. Balance claims 6, 7, 9, 10 and 16 have also been rejected under 35 USC 103 (a) as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1- 3, 5, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishibashi et al (WO 03/105544 corresponding to US 7,469,654 which is referred to hereinafter) in view of Ishii et al (US 2004/0149741) and Hongo et al (US 2001/0050059).

Regarding Claim 1: Ishibashi et al teach a plasma processing apparatus comprising:

- a process vessel 1 in which a substrate 11 is processed;
- a gas introducing part (not shown) that introduces process gas into said process vessel;
- a transmissive window 15 including a dielectric to air-tightly cover an upper opening of the process vessel;

an antenna member 3c, located above the transmissive window, that introduces a microwave into the process vessel;

a support part 10 supporting a peripheral edge portion of said transmissive window 15; and an exhaust pipe (not shown) that exhausts an atmosphere in the process vessel via an exhaust device 9,

wherein said transmissive window 15 has, in a center area thereof, a hanging portion (with side wall 31 shown in Figure 20) made of a same material as a material of said transmissive window, and a gap with a predetermined distance is formed between an outer peripheral surface 31 of the hanging portion and a sidewall of said support part 10 and wherein the gap extends over an entirety of the vertical length of the hanging portion such that there is a uniform gap width (e.g. Figs. 20, 21 and col. 11, lines-8-30).

Ishibashi et al teach a gap between an outer peripheral surface of the hanging portion and a sidewall of said support part but do not teach L/D is equal to 3 or more, where L is a vertical length of the hanging portion and D is the predetermined distance.

Ishii et al teach a plasma apparatus comprising a plasma processing chamber 3 with a transmissive window 5, wherein the transmissive window 5 has a hanging portion (comprising projecting shape 9) in a center area thereof and wherein outer peripheral surface of the hanging portion forms a gap with a sidewall of a supporting portion of the chamber, that supports the transmissive window. Ishii et al further teach that height of projecting portion 9 (similar to a vertical length L of the hanging portion may be 10 mm or less (e.g. Figs 1, 3 and col. 4, lines 52-58).

It would have been obvious to one of ordinary skills in the art at the time of the invention to keep the vertical length of the hanging portion as 10 mm or less as taught by Ishii et al in the apparatus of Ishibashi to minimize metal contamination in the processing chamber.

Ishibashi et al in view of Ishii et al teach a gap between an outer peripheral surface of the hanging portion and a sidewall of said support part, and teach vertical length 'L' of the gap, but do not teach L/D is equal to 3 or more, where L is a vertical length of the hanging portion and D is the predetermined distance.

Hongo et al teach a plasma apparatus comprising a gap space 242 formed between dielectric plate 240 and shower plate 250. Hongo et al further teach that gap 242 is provided for generation of plasma. Hongo et al also teach that thickness of gap 242 is varies according to pressure of the reactant gas and can be set to about 0.5 mm (e.g. Figs. 14, 15 and para. 0100). It would be obvious to keep the predetermined distance as 0.5 mm (depending upon pressure of the reactant gas), implying that L/D would be a $10/0.5 = 20$ (which meets the claimed ratio of 3 or more). [Examiner notes that applicant's data of contamination (para. 0047-0048 of applicant's specification) indicates only a marginal benefit of having a hanging portion 21(viz. change from $16 \times 10 \text{ sup.} 10$ to $7.5 \times 10 \text{ sup.} 10$) in respect of contamination amount of aluminum, wherein the contamination amount is interpreted to be in units of moles or atoms. In the absence of disclosure of any unexpected results for keeping the claimed ratio of L/D to be 3 or more, it would be obvious to optimize the distance D as per process limitations like pressure of the reactant gas to obtain the predictable results of preventing abnormal discharge and obtain enhanced uniformity of plasma processing].

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the ratio of L/D as 3 or more as taught by Hongo et al in the apparatus of

Ishibashi et al in view of Ishii et al to prevent abnormal discharge and avoid metal contamination.

Regarding Claims 2, 3: Ishibashi et al in view of Ishii et al teach a gap with predetermined distance is formed between an outer peripheral surface of the hanging portion and a sidewall of said support part (as explained above under claim 1).

Ishibashi et al in view of Ishii et al do not explicitly teach that the predetermined distance is 0.5 to 10 mm/5 mm.

Hongo et al as explained above teach the predetermined gap can be about 0.5 mm to prevent abnormal discharge. Hongo et al also teach that thickness of gap 242 is varied according to pressure of the reactant gas and can be set to about 0.5 mm (which touches the start of the claimed range of 0.5 mm – 5/10 mm {e.g. Figs. 14, 15 and para. 0100}). It would be obvious to optimize the predetermined distance between an outer peripheral surface of the hanging portion and a sidewall of said support part in view of teaching of Hongo et al to prevent occurrence of abnormal discharge.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the predetermined distance between an outer peripheral surface of the hanging portion and a sidewall of said support part as taught by Hongo et al in the apparatus of Ishibashi et al in view of Ishii et al to prevent occurrence of abnormal discharge.

Regarding Claim 5: Ishibashi et al teach a recessed portion is formed in a center side area of the hanging portion (e.g. Figs. 18, 19).

Regarding Claim 9: Ishibashi et al teach all limitations of the claim but do not teach a vertical length of the hanging portion is 20 mm or more.

Ishii et al teach a plasma apparatus comprising a plasma processing chamber 3 with a transmissive window 5, wherein the transmissive window 5 has a hanging portion (comprising projecting shape 9) in a center area thereof and wherein outer peripheral surface of the hanging portion forms a gap with a sidewall of a supporting portion of the chamber, that supports the transmissive window. Ishii et al further teach that height of projecting portion 9 (similar to a vertical length L of the hanging portion may be 20 mm or less (e.g. Figs 1, 3 and col. 4, lines 52-58) { which touches the claimed limitation of 20 mm }.

It would have been obvious to one of ordinary skills in the art at the time of the invention to keep the vertical length of the hanging portion as 20 mm as taught by Ishii et al in the apparatus of Ishibashi to minimize metal contamination in the processing chamber.

Claims 6, 7, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishibashi et al (WO 03/105544 corresponding to US 7,469,654 which is referred to hereinafter) in view of Ishii et al (US 2004/0149741) and Hongo et al (US 2001/0050059) as applied to claims 1-3, 5, 9 and further in view of Mabuchi et al (US 6,091,045).

Regarding Claim 6: Ishibashi et al in view of Ishii et al and Hongo et al teach all limitations of the claim including recessed portion formed in a center side area of the hanging portion, but do not explicitly teach a sidewall forming the recessed portion is a tapered surface inclining toward a center side of the recessed portion.

Mabuchi et al teach a plasma apparatus comprising a process chamber 11 and a transmissive plate 14 with a hanging portion and a recesses portion formed in a center side area of the hanging portion. Mabuchi further teach that the recessed portion can be suitably shaped

including a tapered surface inclining toward a center side of the recessed portion to further improve plasma uniformity (e.g. Figs. 2, 7, 9-11 and col. 4, line 30 to col. 6, line 67).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the recess with a tapered surface inclining towards a center side of the recessed portion as taught by Mabuchi et al in the apparatus of Ishibashi et al in view of Ishii et al and Hongo et al to obtain enhanced uniformity of plasma processing.

Regarding Claim 7: Ishibashi et al in view of Ishii et al and Hongo et al teach all limitations of the claim but do not teach width of the hanging portion is $\lambda/4$ or less, where λ is wavelength of microwaves in the said transmissive window.

Mabuchi et al teach a plasma apparatus with a transmissive window 14 with a hanging portion 14b (Fig. 11). Mabuchi et al further teach that width of the hanging portion is $\{(DA2-DA1)/2\} = (258-190)/2 = 34$ mm. Mabuchi et al also teach that diameter of recess is determined based upon process limitations like uniformity of processing, higher rate of processing etc, and thus it would be obvious to optimize the width of the hanging portion accordingly (Figs. 10, 11, Table 1 and col. 4, lines 30-62) {claim limitation "width of hanging portion" is interpreted to imply width of hanging portion when the window has a recessed portion in the center area}.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the width of the hanging portion as taught by Mabuchi et al in the apparatus of Ishibashi et al in view of Ishii et al and Hongo et al to obtain enhanced uniformity of plasma processing.

Regarding Claim 16: Ishibashi et al in view of Ishii et al and Hongo et al teach all limitations of the claim but do not explicitly teach corner portions on a boundary between the outer peripheral surface of the hanging portion and a portion, in the transmissive window,

supported by the support part, and corner portions on a boundary between the outer peripheral surface of the hanging portion and a lower surface of the hanging portion, have a curved surface shape.

Mabuchi et al teach a plasma apparatus comprising a process chamber 11 and a transmissive plate 14 with a hanging portion and a recessed portion formed in a center side area of the hanging portion. Mabuchi further teach that the recessed portion can be suitably shaped including a tapered surface inclining toward a center side of the recessed portion to obtain enhanced plasma uniformity. Mabuchi et al teach edge of recess 14a may be curved (e.g. Fig. 7 and col. 5, lines 10-15). It would be obvious to provide curves at corners of the transmissive plate, viz. corner portions on a boundary between the outer peripheral surface of the hanging portion and a portion, in the transmissive window, supported by the support part, and corner portions on a boundary between the outer peripheral surface of the hanging portion and a lower surface of the hanging portion, in view of teachings of Hongoh et al to prevent electric field concentrations for abnormal discharge and obtain improved uniformity of plasma processing.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide curves at corners of the transmissive plate, viz. corner portions on a boundary between the outer peripheral surface of the hanging portion and a portion, in the transmissive window, supported by the support part, and corner portions on a boundary between the outer peripheral surface of the hanging portion and a lower surface of the hanging portion as taught by Mabuchi et al in the apparatus of Ishibashi et al in view of Ishii et al and Hongo et al to prevent electric field concentrations for abnormal discharge and obtain improved uniformity of plasma processing.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ishibashi et al (WO 03/105544 corresponding to US 7,469,654 which is referred to hereinafter) in view of Ishii et al (US 2004/0149741) and Hongo et al (US 2001/0050059) as applied to claims 1 – 3, 5, 9 and further in view of O'Donnell et al (US 2004/0002221).

Regarding Claim10: Ishibashi et al in view of Ishii et al and Hongo et al teach all limitations of the claim except the support part or the side wall facing the inside of the process vessel is coated with Y2O3.

O'Donnell et al teach a plasma apparatus wherein interior chamber walls, dielectric window etc are coated with Y2O3 to prevent their deterioration when exposed to plasma (para. 0050).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a coating of Y2O3 on the support part as taught by O'Donnell et al in the apparatus of Ishibashi et al in view of Ishii et al and Hongo et al to prevent deterioration when exposed to plasma.

Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongoh et al (US 2002/0066536) in view of Hongo et al (US 2001/0050059).

Regarding Claim 11: Hongoh et al teach a plasma processing apparatus comprising:
a process vessel 36 in which a substrate W is processed;
a gas introducing part 54 (gas supply nozzle) that introduces process gas into said process vessel;

a transmissive window 80 (insulating plate) including a dielectric to air-tightly cover an upper opening of the process vessel 36;

an antenna member 86 located above the transmissive window 80 that introduces a microwave into the process vessel;

a support part 78 (supporting frame member) supporting a peripheral edge portion of said transmissive window 80; and an exhaust pipe (connected to exhaust opening 76) that exhausts an atmosphere in the process vessel 36 via an exhaust device (not shown),

wherein under said support part 78, an eave portion 52 (plasma gas supply nozzle) projecting from a sidewall of the process vessel 36 towards an interior of the process vessel is separate from a contact point between the support part 78 and a lower surface of said transmissive window 80 by a predetermined distance (e.g. Fig. 1 and at least para. 0025-0028) {claim does not limit that the eave portion can not be a gas supply part}.

Hongoh et al do not teach the eave portion is disposed on an entire surface in a circumferential direction.

Hongo et al teach a plasma apparatus comprising a process chamber 102 with a transmissive plate 230 supported by a support part (top wall portion of the process chamber) and an eave portion 170 (gas supply ring) disposed on an entire surface in a circumferential direction of the process chamber 102 (e.g. Fig. 1 and at least para. 0056).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the eave portion disposed on an entire surface in a circumferential direction of the process chamber 102 as taught by Hongo et al in the apparatus of Hongoh et al to enable supply plasma gas uniformly in the process chamber.

Regarding Claims 12, 13: Hongoh et al teach all limitations of the claim but do not teach the predetermined distance is 0.5 to 10 mm or 0.5 to 5 mm (for claim 13).

Hongo et al teach a plasma apparatus comprising a gap space 242 formed between dielectric plate 240 and shower plate 250. Hongo et al further teach that gap 242 is provided for generation of plasma. Hongo et al also teach that thickness of gap 242 is varies according to pressure of the reactant gas and can be set to about 0.5 mm (which touches the starting point of the claimed range) {e.g. Figs. 14, 15 and para. 0100}. It would be obvious to optimize the predetermined distance depending upon process limitation like gas pressure to avoid high electrical field near the support part and avoid metal contamination.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the predetermined distance depending as taught by Hongo et al in the apparatus of Hongoh et al depending upon process limitation like gas pressure to avoid high electrical field near the support part and avoid metal contamination.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/RAKESH DHINGRA/
Primary Examiner, Art Unit 1716